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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,476	11/19/2003	Makoto Shizukuishi	0649-0923P	3741

2292 7590 07/22/2009
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EXAMINER	
HSU, AMY R	

ART UNIT	PAPER NUMBER
2622	

NOTIFICATION DATE	DELIVERY MODE
07/22/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/715,476	SHIZUKUISHI, MAKOTO	
	Examiner	Art Unit	
	AMY HSU	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 June 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/9/2009 has been entered.

Response to Arguments

2. Applicant's arguments filed 6/9/2009 have been fully considered but they are not persuasive. Applicant had amended independent claims 1, 2, 19, 43, and 44 to include the further limitation of an element isolation zone arranged between the segments in one photoelectric conversion area, wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas. Upon examination of the language of said amendment, the Office maintains that the prior art cited in the previous final rejection still teaches the added limitation because of the broad language of the claims. Meyers (US 6137535), cited in the final rejection, teaches one segment of a photoelectric conversion area in Fig. 6 reference number 24. The element isolation zone is the shaded gray area on either side of reference number 24 and therefore said zone is arranged between the segments. Fig. 6 shows a device level drawing where to the right of transistor 65 and to the left of transistor 66 is a

transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24. The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between the first group and second group there exist transfer electrodes of the adjacent segments. The language of the claims does not limit the transfer electrodes to be outside or beyond the photoelectric conversion areas, nor does the claims further limit the function or placement of the element isolation zone around the prior art as stated above. Therefore given the broad interpretation explained above, the Office maintains that Meyers teaches the independent claims as currently amended.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1,3-5,11,13,15,18,43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) view of Nayer et al. (US 7084905).

Regarding Claim 1, Meyers teaches a color solid-state image pickup device including a plurality of photoelectric conversion areas (*Fig. 2 reference number 24, "photodetector elements")* provided in an array pattern (*reference number 20, "photosensor array")* on a surface of a semiconductor substrate (*reference number 100*

"substrate"), and a light-shielding film (*reference number 16, "opaque mask", Col 4 Lines 39-41 "prevent light that would by-pass the lenslets from reaching the photosensitive array")*, wherein the inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric conversion signals of different spectral sensitivities (*Fig. 1B shows one photodetector element partitioned into red, green, blue segments)*, using transfer electrodes (*Fig. 6 reference number 65, transfer gate which is also known in the art as transfer electrode)* and wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said photoelectric conversation areas (*Fig. 2 shows one aperture corresponding to one photodetector element which contains at least two segments)*. Meyers teaches that diameter of said aperture is larger than a dimension of at least one segment (*Fig. 2 shows this proportion clearly, where one segment is a small box marked "G" or "R" on reference number 22)*. Meyers also teaches a distance between two of said transfer electrodes is smaller than a distance across segments adjacent to said two transfer electrodes (*Fig. 6 shows that there is on transfer electrode per segment, reference number 24 and Fig. 2 shows that the distance between two reference number 24s within one subgroup reference number 22, is smaller than the distance across segments adjacent to said two transfer electrodes which is the distance between one segment in one subgroup from another segment reference number 24 in an adjacent subgroup 22)*.

Meyers further teaches the image pickup device further comprising an element isolation zone arranged between the segments in one photoelectric

conversion area (*Fig. 6*, Fig. 6 shows a device level drawing where to the right of transistor 65 and to the left of transistor 66 is a transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24), wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas (The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between the first group and second group there exist transfer electrodes of the adjacent segments).

However, Meyers does not teach the diameter of said aperture is smaller than the diameter of said one photoelectric conversion area. Nayer shows a similar diagram in Fig. 11 which clearly shows the diameter of the aperture (*reference number 118)* is smaller than the diameter of the photodiode *(reference number 115*). See Col 15 line 67 through Col 16 Line 9.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Nayer to vary the sizes of the aperture in the light shielding layer with respect to the size of the photodiode including aperture being smaller than photodiode because forming the apertures at this predetermined size can form spatially varying sensitivity patter for the image sensor as is used by Nayer. Additionally, the aperture being smaller than the photoelectric

conversion area will ensure the light is focused on the photoelectric conversion area and no part is unused.

Regarding Claim 3, Meyers teaches the color solid-state image pickup device according to claim 1, wherein the surface of said semiconductor substrate is covered with said light-shielding film having apertures corresponding to said respective photoelectric conversion areas (*Fig. 2)*.

Regarding Claim 4, Meyers teaches the color solid-state image pickup device according to claim 3, wherein the diameter or diagonal dimension of said aperture is larger than the wavelength of incident light (*Fig. 2 shows apertures which permit light through and therefore must be larger than wavelengths of incident light that reach the sensor)*.

Regarding Claim 5, Meyers teaches the color solid-state image pickup device according to claim 1, wherein the spectral sensitivity of at least one segment is determined by a color filter provided at a position above said segment (*Col 5 Lines 47-50)*.

Regarding Claim 11, Meyers teaches the color solid-state image pickup device according to claim 1, wherein each of said photoelectric conversion areas is two-dimensionally partitioned into at least three segments, that is, a segment having red

spectral sensitivity, a segment having green spectral sensitivity, and a segment having blue spectral sensitivity (*Fig. 2 reference number 22)*.

Regarding Claim 13, Meyers teaches the color solid-state image pickup device according to claims 11, wherein each of said photoelectric conversion areas is two-dimensionally partitioned into at least four segments, that is, a segment having red spectral sensitivity, a segment having green spectral sensitivity, a segment having blue spectral sensitivity, and a segment having spectral sensitivity whose peak appears in the vicinity of a wavelength of 520 nm (*Fig. 2 reference number 22, where a segment marked green is known to one of ordinary skill in the art to have a spectral sensitivity whose peak appears in the vicinity of 520nm)*.

Regarding Claim 15, Meyers teaches the color solid-state image pickup device according to claim 1, wherein arrangement of segments having the same spectral sensitivity differs from one photoelectric conversion area to an adjacent photoelectric conversion area (*Fig. 1B reference number 24)*.

Regarding Claim 18, Meyers teaches the color solid-state image pickup device according to claim 1, wherein said color solid-state image pickup device is used for a digital camera (*Col 1 Lines 17-20, the invention is applied to use in digital cameras)*.

Regarding Claim 43, Meyers teaches an image pickup device including image capturing means for outputting a plurality of photoelectric conversion signals of different spectral sensitivities (*Fig. 2 reference number 22)*, using transfer electrodes (*Fig. 6 reference number 65, transfer gate which is also known in the art as transfer electrode)* wherein said image capturing means includes a plurality of photoelectric conversion areas provided in an array pattern on a surface of a semiconductor substrate, an inside of each of said photoelectric conversion areas being two-dimensionally partitioned into a plurality of segments, and light-shielding means, wherein an aperture in said light-shielding means corresponds to at least two of said segments in one of said photoelectric conversion areas (*as addressed with Claim 1).* Meyers teaches that diameter of said aperture is larger than a dimension of at least one segment (*Fig. 2 shows this proportion clearly, where one segment is a small box marked "G" or "R" on reference number 22).* Meyers also teaches a distance between two of said transfer electrodes is smaller than a distance across segments adjacent to said two transfer electrodes (*Fig. 6 shows that there is on transfer electrode per segment, reference number 24 and Fig. 2 shows that the distance between two reference number 24s within one subgroup reference number 22, is smaller than the distance across segments adjacent to said two transfer electrodes which is the distance between one segment in one subgroup from another segment reference number 24 in an adjacent subgroup 22).* **Meyers further teaches the image pickup device further comprising an element isolation zone arranged between the segments in one photoelectric conversion area (*Fig. 6*, Fig. 6 shows a device level drawing where to the right of**

transistor 65 and to the left of transistor 66 is a transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24), wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas (The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between the first group and second group there exist transfer electrodes of the adjacent segments).

However, Meyers does not teach the diameter of said aperture is smaller than the diameter of said one photoelectric conversion area. Nayer shows a similar diagram in Fig. 11 which clearly shows the diameter of the aperture (*reference number 118)* is smaller than the diameter of the photodiode *(reference number 115*). See Col 15 line 67 through Col 16 Line 9.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Nayer to vary the sizes of the aperture in the light shielding layer with respect to the size of the photodiode including aperture being smaller than photodiode because forming the apertures at this predetermined size can form spatially varying sensitivity patter for the image sensor as is used by Nayer. Additionally, the aperture being smaller than the photoelectric conversion area will ensure the light is focused on the photoelectric conversion area and no part is unused.

5. Claims 6-7, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905), further in view of Itano (US 7139028).

Regarding Claim 6, Meyers teaches the color solid-state image pickup device according to claim 1, but fails to teach the spectral sensitivity of one segment is determined by the distribution of impurities in a depth wise direction of said segment. Itano teaches the spectral sensitivity of at least one segment of said photoelectric conversion area is determined by the distribution of impurities in a depth wise direction of said segment. Col 8 Lines 8-16 describe the area of Fig. 12 between the microlens which focuses light to the photodiode, and the photodiode which collects the light, and describes the distribution of impurities in a depth wise direction, in this particular example listed it is silicon distributed in a 200nm depth. The impurity and the depth of the different layers between the microlens and the photodiode will determine the spectral sensitivity.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Itano because controlling the type of impurity, amount of impurity, and depth among other variable of the impurity in the photoelectric conversion area is an effective way to accurately control the spectral sensitivity in manufacturing the device.

Regarding Claim 7, Meyers teaches the color solid-state image pickup device according to claim 1, wherein the spectral sensitivity of at least one segment is determined by a color filter (*as addressed with Claim 5)* but fails to teach as well as by the distribution of impurities in a depth wise direction of said segment. However this limitation is addressed with Claim 6. It would have been obvious to combine the use of the filter and impurity doping because both are effective ways to accurately control the spectral sensitivity when manufacturing the device.

Regarding Claim 12, Meyers teaches the color solid-state image pickup device according to claim 1, wherein each of said photoelectric conversion areas is two-dimensionally partitioned into various segments but fails to teach at least four segments, that is, a segment having yellow spectral sensitivity, a segment having cyan spectral sensitivity, a segment having magenta spectral sensitivity, and a segment having green spectral sensitivity. Itano teaches a color solid-state image pickup device using a filter color scheme with the above configuration (*Col 7 Lines 34-35)*.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers and replaces the red, green, blue color scheme with the complementary color scheme because one skilled in the art realizes the complementary color scheme is commonly used and interchangeable with red, green, blue for sharpness and quality.

6. Claims 2,19,20,22-25,31,33,35,40,42,44,45, 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Sonoda et al. (US 2002/0113888).

Regarding Claim 2, Meyers teaches a color solid-state image pickup device including a plurality of photoelectric conversion areas provided in an array pattern *(Fig. 1A)* on a surface of a semiconductor substrate (*Fig. 2 reference number 100)*, wherein an inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which store signal electric charges of different spectral sensitivities (*Fig. 2 reference number 22)*, and teaches a transfer channel in Fig. 6 reference number 65 but fails to teach the transfer channels' direction and position of extension with respect to perimeter of the photoelectric conversion areas. **Meyers further teaches the image pickup device further comprising an element isolation zone arranged between the segments in one photoelectric conversion area (*Fig. 6*, Fig. 6 shows a device level drawing where to the right of transistor 65 and to the left of transistor 66 is a transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24), wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas (The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between**

the first group and second group there exist transfer electrodes of the adjacent segments).

Sonoda teaches a similar image sensor with groups of photoelectric conversion devices arranged in an array with different segments (*Fig. 5),* and transfer channels, for transferring said signal electric charges read from a plurality of said segments, are formed beside said photoelectric conversion areas, said transfer channels extending along perimeters of said photoelectric conversion areas that are partitioned into said plurality of segments which store said signal electric charges of different spectral sensitivities (*Fig. 5 shows transfer channels to the shift registers which are along the perimeters, or around the outside edges of reference number 102a)*, said transfer channels extending substantially parallel to said perimeters (*Fig. 5 of Sonoda further shows in Fig. 5 the transfer channels, reference number 705 extending parallel to the perimeter, specifically the channels are shown to extend in a vertical direction which is parallel to the vertical perimeter of reference number 102 the photo electric conversion areas).*

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Sonoda to have transfer channels along the perimeter of the photoelectric conversion areas in order to efficiently transfer charges from the plurality of different segments of each photosensor to destinations such as shift registers.

Regarding Claim 19, Meyers teaches an image sensor having a plurality of photoelectric conversion areas provided in an array pattern on a surface of a semiconductor substrate (*as addressed with Claim 1)*, wherein an inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which output photoelectric conversion signals having a plurality of different spectral sensitivities (*Fig. 2 reference number 22)* , and peripheral circuits connected to said segments are arranged around said photoelectric conversion areas, along perimeters of said photoelectric conversion areas (*Fig. 1B reference numbers 56,48,40,58 circuits arranged around reference number 24, photodetector elements)*. **Meyers further teaches the image pickup device further comprising an element isolation zone arranged between the segments in one photoelectric conversion area (*Fig. 6*, Fig. 6 shows a device level drawing where to the right of transistor 65 and to the left of transistor 66 is a transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24), wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas (The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between the first group and second group there exist transfer electrodes of the adjacent segments).**

Meyers does not teach the image sensor is MOS type. Sonoda teaches a MOS image sensor (*paragraph 66)* with the above limitations that Meyers teaches (*See Figs. 3B, 5,*

and 14). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Sonoda to realize the invention of Meyers using a MOS type image sensor. Sonoda exemplifies a MOS image sensor arranged in an array with each corresponding to an aperture in a light shielding film. It would have been obvious to modify Meyer's invention with MOS image sensor to achieve a device with lower power consumption which decreases noise. Transfer channels, for transferring signal electric charges read from a plurality of said segments, are formed besides said photoelectric conversion areas, said transfer channels extending along perimeters of said photoelectric conversion areas. Sonoda teaches a similar image sensor with groups of photoelectric conversion devices arranged in an array with different segments (*Fig. 5),* and transfer channels, for transferring said signal electric charges read from a plurality of said segments, are formed beside said photoelectric conversion areas, said transfer channels extending along perimeters of said photoelectric conversion areas that are partitioned into said plurality of segments which store said signal electric charges (*Fig. 5 shows transfer channels to the shift registers which are along the perimeters, or around the outside edges of reference number 102a)* said transfer channels extending substantially parallel to said perimeters (*Fig. 5 of Sonoda further shows in Fig. 5 the transfer channels, reference number 705 extending parallel to the perimeter, specifically the channels are shown to extend in a vertical direction which is parallel to the vertical perimeter of reference number 102 the photo electric conversion areas).*

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Sonoda to have transfer channels along the perimeter of the photoelectric conversion areas in order to efficiently transfer charges from the plurality of different segments of each photosensor to destinations such as shift registers.

Regarding Claims 20, 25,31,33,35, and 40, Meyers in view of Sonoda teach Claim 19, and Meyers further teaches the limitations as addressed with previous claims including Claims 5, 11, 13, 15 and 18.

Regarding Claim 22, Meyers in view of Sonoda teach the MOS image sensor according to claim 20, and Meyers further teaches one microlens is provided so as to correspond to one aperture (*Fig. 2).*

Regarding Claims 23 and 24, Meyers in view of Sonoda teach the MOS image sensor according to claim 19, Meyers further teaches the photoelectric conversion signals are sequentially read from respective segments into which said photoelectric conversion area is two-dimensionally partitioned, and output to a common signal line (*Fig. 6, signals from each photo detector element in a group are read)*

Regarding Claim 38-39, Meyers in view of Sonoda teach the MOS image sensor of claim 19, Meyers further teaches the image sensor is active type (*Col 11 Lines 56-*

57), and one of ordinary skill in the art would recognize to use passive type as another option because less expensive and widely used in low-end digital cameras.

Regarding Claim 42, Meyers in view of Sonoda teach the MOS image sensor according to claim 19, and Meyers further teaches the array pattern is arranged in a grid pattern (*Fig. 1A).*

Regarding Claim 44, Meyers teaches an image pickup device for outputting a plurality of photoelectric conversion signals of different spectral sensitivities (*Fig. 2).* **Meyers further teaches the image pickup device further comprising an element isolation zone arranged between the segments in one photoelectric conversion area (*Fig. 6*, Fig. 6 shows a device level drawing where to the right of transistor 65 and to the left of transistor 66 is a transistor isolation area. Past said isolation area is what is considered the element isolation zone of reference number 24), wherein the transfer electrodes are formed so as to avoid said element isolation zone and to exist between said photoelectric conversion areas (The transfer electrodes, reference number 65 transfer gate, therefore are avoiding and not overlapping with the element isolation zone, yet the transfer electrodes exist between said photoelectric conversion areas. In Fig. 2, between the first group and second group there exist transfer electrodes of the adjacent segments).**

Meyers does not teach signal storing means. Sonoda teaches signal storing means for storing electric charges in a plurality of segments which are partitioned by dividing an inside of a plurality of photoelectric conversion areas being formed in an array pattern on a surface of a semiconductor substrate (*Fig. 5, vertical and horizontal shift register is the storing means)*, and signal transfer means for transferring said electric charges read from a plurality of said segments through channels being formed beside said photoelectric conversion areas, said channels being formed along perimeters of said photoelectric conversion areas (*the lines extending from the VSR and HSR are the transfer means)* said transfer channels extending substantially parallel to said perimeters (*Fig. 5 of Sonoda further shows in Fig. 5 the transfer channels, reference number 705 extending parallel to the perimeter, specifically the channels are shown to extend in a vertical direction which is parallel to the vertical perimeter of reference number 102 the photo electric conversion areas).*

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with that of Sonoda to have transfer channels along the perimeter of the photoelectric conversion areas to in order to efficiently transfer charges from the plurality of different segments of each photosensor.

Regarding Claim 45, Meyers in teaches the color solid-state image pickup device according to Claim 2, where the surface of said semiconductor substrate is covered with a light-shielding film having apertures corresponding to said respective photoelectric conversion areas (*Fig. 2)*.

Regarding Claims 47-49, Meyers in view of Nayer fail to teach the limitations of claims 47-49 however as addressed with Claim 2, Sonoda is combined to teach transfer channels extending around perimeters of the photoelectric conversion areas. Sonoda further teaches in Fig. 5 that the transfer channels extend between the photoelectric conversion areas, along the perimeters of the photoelectric conversion areas. For example at the lower left corner of Fig. 5, the lines corresponding to reference number 705 are between the photoelectric conversion areas (the columns), and are along the perimeters as addressed with Claim 2.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Meyers in view of Nayer with that of Sonoda for the same rationale as claim 2.

7. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) further in view of Itano (US 7139028) and further in view of Suzuki et al. (US 6933972).

Regarding Claim 8, Meyers in view of Nayer further in view of Itano teach the color solid-state image pickup device according to claim 6, but fail to specifically teach the doping of each layer.

Since Meyers in view of Nayer further in view of Itano is silent on the details such as polarity of each layer, one of ordinary skill in the art would look to prior art for design details. Suzuki teaches in Fig. 12 a solid state image pickup device where one segment has a p-well layer (*Fig. 12 reference number 1a)* in an n-type substrate (*Fig.*

12 reference number 1) and an n-type impurity layer formed in the p-well layer (*Fig. 12 reference number 10a, Col 19 Lines 42-49).* One of ordinary skill in the art will recognize that spectral sensitivity of the photodiode is determined by the depth of the layers formed on the substrate because such technology makes use of the dependence on the light's wavelength of optical absorption and free carrier generation inside the semiconductor material, and also the light's penetration depth into the semiconductor material increases with increased wavelength.

It would be obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers in view of Nayer further in view of Itano by using the specific arrangement taught by Suzuki because varying the depth of the layers corresponds to the wavelength of light, or color focused on the photodiode.

Regarding Claims 9, Meyers in view of Nayer further in view of Itano teach the color solid-state image pickup device according to claim 8, but fails to teach the limitations of Claim 9 and 10. One of ordinary skill in the art would recognize to vary the depth of the layers corresponding to the color of light absorbed. The layers will be thinner for blue spectral sensitivity and relatively deeper for green and further deeper for segments with red spectral sensitivity because one of ordinary skill in the art recognizes that penetration depth of the light into the semiconductor material is directly dependent on the wavelength of light. Therefore red light with relatively longer wavelength than green light will penetrate deeper into the semiconductor material and

thus requires a thicker semiconductor layer to absorb focused red light relative to green.

Regarding Claim 10, Meyers in view of Nayer further in view of Itano and Suzuki teach the limitations of Claim 9. One of ordinary skill in the art would realize the option of interchanging the n-type and p-type impurity, as long as the reverse polarity is kept from layer to layer. Claim 10 is rejected similarly to Claim 9.

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) further in view of Tabei (US 5063439).

Regarding Claim 14, Meyers in view of Nayer teach the color solid-state image pickup device according to claim 13, but fails to teach the limitations of Claim 14.

Tabei teaches a solid state pickup system and focuses on techniques for improved color reproducibility, including processing performed by means of a signal read from said segment having spectral sensitivity whose peak appears in the vicinity of a wavelength of 520 nm (*Fig. 1, 3)*, thereby performing color reproduction analogous to a color matching function (*Fig. 9 and Col 2)*.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Meyers in view of Nayer with the teachings of Tabei to improve the color reproducibility.

9. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) further in view of Usui (US 5055921).

Regarding Claim 16, Meyers in view of Nayer teach the color solid-state image pickup device according to claim 1, but is silent on the relative areas of the different segments in the photoelectric conversion device.

Usui teaches a sensor array with color filter elements where at least one color segments differs in area from the other segments. Output from the blue filter is smaller than those of red and green filter elements and therefore degrades S/N ratio of the blue filter output. Usui teaches making the blue area larger to compensate (*Figs. 3, 5, 7B, and Col 1 Lines 25-32).*

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers in view of Nayer with that of Usui to differ the areas of the different segments within the photoelectric conversion area in order to compensate for outputs from the different areas due to differing spectral sensitivity.

Regarding Claim 17, Meyers in view of Nayer further in view of Usui teach the color solid-state image pickup device according to claim 16, and Usui further teaches the area of the segments is inversely proportional to the magnitude of relative spectral sensitivity, for example blue has lower spectral sensitivity than red and green and

therefore has a larger area as seen in Figs 3, 5. It would have been obvious to combine for the same rationale as Claim 16.

10. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888) further in view of Itano (US 7139028).

Regarding Claim 21, Meyers in view of Sonoda teach the MOS image sensor according to Claim 20, but fails to teach the limitation of Claim 21. For design purpose, one of ordinary skill in the art would be motivated to look to established designs in prior art.

Itano teaches a similar image pickup apparatus where a microlens is arranged above an aperture in a light shielding film corresponding to a photoelectric conversion area, Fig. 10, which shows the aperture diameter being smaller than the diameter of the photoelectric conversion area.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Meyers in view of Sonoda with that of Itano because designing a smaller diameter aperture relative to the photosensor will prevent excess light to be exposed past the borders of the photosensor, and improve the sensitivity if light coming through the aperture is focused only on the photosensor.

11. Claim 26-27, 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888), further in view of Itano (US 7139028).

Regarding Claim 26, Meyers in view of Sonoda teaches the MOS image sensor of claim 19 and Itano further teaches the Itano teaches the spectral sensitivity of at least one segment of said photoelectric conversion area is determined by the distribution of impurities in a depth wise direction of said segment. Col 8 Lines 8-16 describe the area of Fig. 12 between the microlens which focuses light to the photodiode, and the photodiode which collects the light, and describes the distribution of impurities in a depth wise direction, in this particular example listed it is silicon distributed in a 200nm depth. The impurity and the depth of the different layers between the microlens and the photodiode will determine the spectral sensitivity.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers in view of Sonoda with that of Itano because controlling the type of impurity, amount of impurity, and depth among other variable of the impurity in the photoelectric conversion area is an effective way to accurately control the spectral sensitivity in manufacturing the device.

Regarding Claim 27, Meyers in view of Sonoda teach the color solid-state image pickup device according to claim 19, wherein the spectral sensitivity of at least one segment is determined by a color filter (*as addressed with Claim 5)* but fails to teach as well as by the distribution of impurities in a depth wise direction of said segment. However this limitation is addressed with Claim 26. It would have been obvious to

combine the use of the filter and impurity doping because both are effective ways to accurately control the spectral sensitivity when manufacturing the device.

Regarding Claim 32, Meyers in view of Sonoda teach the color solid-state image pickup device according to claim 19, wherein each of said photoelectric conversion areas is two-dimensionally partitioned into various segments but fails to teach at least four segments, that is, a segment having yellow spectral sensitivity, a segment having cyan spectral sensitivity, a segment having magenta spectral sensitivity, and a segment having green spectral sensitivity. Itano teaches a color solid-state image pickup device using a filter color scheme with the above configuration (*Col 7 Lines 34-35)*.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers in view of Sonoda and replaces the red, green, blue color scheme with the complementary color scheme because one skilled in the art realizes the complementary color scheme is commonly used and interchangeable with red, green, blue for sharpness and quality.

12. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535)) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888) further in view of Itano (US 7139028).

Regarding Claim 46, Meyers in view of Nayer in view of Sonoda teach the color solid state image pickup device according to claim 45, wherein the diameter or diagonal dimension of said aperture is larger tan the wavelength of incident light (*Fig.*

3B shows apertures which permit light through and therefore must be larger than wavelengths of incident light that reach the sensor) does not specifically address the relative size of the aperture diameter with respect to the photo sensor. For design purpose, one of ordinary skill in the art would be motivated to look to established designs in prior art.

Itano teaches a similar image pickup apparatus where a microlens is arranged above an aperture in a light shielding film corresponding to a photoelectric conversion area, Fig. 10, which shows the aperture diameter being smaller than the diameter of the photoelectric conversion area.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teaching of Meyers in view of Sonoda with that of Itano because designing a smaller diameter aperture relative to the photosensor will prevent excess light to be exposed past the borders of the photosensor, and improve the sensitivity if light coming through the aperture is focused only on the photosensor.

13. Claim 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888) and Suzuki (6933972).

Meyers in view of Sonoda teaches the MOS image sensor of claim 19 and the limitations of Claim 28-30 are addressed with claims 8-10. It would have been obvious for the same rationale as addressed above with Claims 8-10.

14. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888), further in view of Tabei (US 5063439).

Regarding Claim 34, Meyers in view of Sonoda teaches the MOS image sensor of claim 19, and is further rejected similarly as claim 14.

15. Claim 36-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sonoda et al. (US 2002/0113888), further in view of Usui (US 5055921).

Regarding Claim 36-37, Meyers in view of Sonoda teaches the MOS image sensor of claim 19, and is further rejected similarly as claim 16-17.

16. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (US 6137535) in view of Nayer et al. (US 7084905) in view of Sigmoid et al. (US 5289269).

Regarding Claim 41, Meyers in view of Nayer teach the color sold-state image pickup device according to claim 1, but fails to teach array pattern is arranged by offsetting odd lines from even lien by half a pitch.

It is well known in the art to interlace signals from CCDs by offsetting odd lines from even lines by half a pitch. The concept is taught by Sugimori *(Col 1 Lines 15-19 and Fig. 10)*. Sugimori applies the concept to produce a non-interlaced system (*Fig.*

4), which is desired to avoid enlarging the circuit, and avoid adding to the cost of the circuit.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teaching of Meyers with the teaching of Sugimori because arranging the pixels by offsetting the odd lines from even liens by half a pitch opens up many possibilities to enhance the light signals from the pixels and thus create a more efficient circuit.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMY HSU whose telephone number is (571)270-3012. The examiner can normally be reached on M-F 8am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on 571-272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Lin Ye/
Supervisory Patent Examiner, Art Unit 2622

ARH 7/16/09